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COMPUTER ABSTRACTS

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GENERAL

1588 **Are your computers protected against fire?** *Control Engng.*, **8,** June 1961, 131-134. Some recommendations from the U.S. National Fire Protection Association on protection of records, fire emergency procedures, protection of computer rooms and equipment, general computer room requirements, building construction requirements and utilities.

1589 **Automatic computing machinery—list of types.** *Computers & Automn.*, **10,** June 1961, 128-130. List of types of machinery that may properly be considered varieties of automatic computing or data processing machinery, e.g. accounting-bookkeeping machines, ballistic computers, card-to-tape converters, game-playing machines, process controllers, etc.

1590 **Buyers' guide for the computer field: products and services for sale or rent.** *Computers & Automn.*, **10,** June 1961, 42-78, 80-87. Brief description of products and services are classified under some 200 headings.

1591 **The Computer Directory and Buyers' Guide, 1961.** *Computers & Automn.*, **10,** June 1961, complete issue. This directory includes lists of organisations in the computer field, products and services, characteristics of analogue and digital computers and other items. For further details see abstracts of the individual items under Refs. 1589, 1590, 1592, 1598, 1599, 1601, 1602, 1642, 1667, 1701, 1703, 1708 and 1803.

1592 **Computer users groups—roster.** *Computers & Automn.*, **10,** June 1961, 139, 148. List of 17 U.S. computer users groups.

1593 **Electronic data processing and the office worker.** A. A. Blum, *Data Processing (Detroit)*, **3,** June 1961, 11-14. A Professor of Social Sciences gives his views on personnel displacement and unemployment caused by the use of computers for data processing and on the effect of electronic data processing on those office workers who remain at work.

1594 **The human element. F. C. VandenBosch**, *Data Processing (Detroit)*, **3,** June 1961, 16-18. An account of how the Detroit Edison Company dealt with personnel problems brought about by the installation of an IBM 705 and of their plans for avoiding personnel displacement.

1595 **No bristles on Gillette.** W. Brackman, *Auto. Data Processing*, **3,** June 1961, 14-18, 40. A general account of how the Gillette Company of Boston, Massachusetts, U.S.A., investigated the possibility of using a computer and of their experience with the IBM 650 which was installed. It is mentioned that the IBM 650 has now been replaced by a combined 7070-1401 system.

1596 **The organisation of an ADP centre.** J. P. Loorij, *Computer Bull.*, **5,** June 1961, 11-18. This article describes at some length the organisation of the Vereniging voor Centrale Elektronische Administratie (CEA) which aims to give the advantages of the use of electronic data processing machines to small and large companies and through this to relieve the participating companies of a great quantity of administrative detail without affecting anything that is special to these companies, or taking any management responsibility in the field of administration. Initially, the CEA will be mainly concerned with payroll applications. The feasibility of central processing of payrolls is discussed with regard to such matters as reliability, speed, flexibility and the transfer of data between the participating companies and the centre. The basic procedure is outlined and the required features of a data processor are discussed.

1597 **Les perspectives du calcul analogique optique** (The prospects for optical analogue computation). P. Braffort, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 109-110. (In French) The advantages of and the possibilities of realising analogue equipment of an optical nature are briefly discussed. It is suggested that optical techniques would be particularly suitable for combined analogue-digital computers and that they have particular advantages in various applications, especially in the nuclear field. 7 refs.

1598 **Roster of organizations in the computer field.** *Computers & Automn.*, **10,** June 1961, 10-41, 125. Alphabetical list of some 700 (mainly American) organisations, with details of their products and/or services.

1599 **Roster of school, college, and university computer centers.** *Computers & Automn.*, **10,** June 1961, 140-142. List of 49 (mainly U.S. and British) school, college and university computing centres, with brief details of activities, equipment, etc.

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1600 **The selection and training of computer personnel.** D. Hooper, *Computer Bull.*, **5,** June 1961, 26-37. Report of a discussion meeting of the British Computer Society held in November 1960. The main topics dealt with are the selection and training of maintenance engineers and of programmers, training in universities and technical colleges, and recruitment problems.

1601 **Survey of computing services.** *Computers & Automn.*, **10,** June 1961, 88-94. Alphabetical listing of 90 (mainly American) computing services with brief information as to equipment and problems specialised in.

1602 **Survey of consulting services.** *Computers & Automn.*, **10,** June 1961, 96-98. Alphabetical listing of 74 (mainly American) computer consulting services with brief details of facilities and problems.

1603 **What can you learn by 'home study'?** M. Moseley, *Auto. Data Processing,* **3,** June 1961, 25-26. A brief account is given of some correspondence courses available in programming and data processing, and a manufacturer's training executive's opinion of such courses is reported.

DESIGN

1604 **A bibliographical sketch of all-magnetic logic schemes.** D. R. Bennion, H. D. Crane and D. C. Engelbart, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 203-206. An all-magnetic logic scheme is one with which a workable digital system could be constructed involving only magnetic elements, current-carrying conductors and sources of clock pulses. Historical developments of both resistance (dependent upon coupling-loop resistance) and nonresistance schemes (possessing at least first-order independence of coupling-loop resistance) are described, with reference to all relevant published work known to the authors. The paper includes: schemes using electric-circuit transfer linkage with simple cores, multipath cores and thin film elements; and schemes using continuous magnetic structures where transfer linkage is purely magnetic. The paper is in the form of a general introduction followed by an annotated bibliography containing 53 references.

1605 **Combined analog-digital computer system.** M. Paskman and J. Heid, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 16 p. This paper describes the functional design and operation of the large scale, general purpose Combined Analog-Digital Computer System (CADCS) developed and used by the General Electric Missile and Space Vehicle Department. The system, designed to meet the requirements of complex system simulation, consists of a general purpose analogue computer and a digital computer (IBM 704 or 7090) linked through a Hybrid Computer Link (HYCOL). The design of the HYCOL unit allows the analogue computer to be placed completely (except for patching) under the control of the digital computer.

1606 **A combined analog-digital differential analyzer (CADDA).** W. D. Urban, W. R. Hahn and H. K. Skramstad, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 12 p. In 'A combined analog-digital differential analyzer', H. K. Skramstad, *Proc. Eastern Joint Computer Conference,* 1959, 94-99 (*C.A.*, **4,** July 1960, Ref. 1264), a concept is introduced of employing analogue and digital techniques in a differential analyser in which dependent variables are represented by two quantities: a digital number representing the more significant part and an analogue voltage representing the less significant part. The present paper is concerned with a study of the problems in the design, construction and use of integrators and multipliers for such a differential analyser. The mathematical basis for the design is given and the construction and operation of prototype units are briefly described. 2 refs.

1607 **Design of an all-magnetic computing system: Part I—Circuit design.** H. D. Crane and E. K. Van De Riet, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 207-220. This paper describes the circuits used in a decimal arithmetic unit which utilises ferrite magnetic elements and copper conductors only. The arithmetic operations of addition, subtraction and multiplication are performed with a product and sum capacity of three decimal digits. The sole logical building block of this system is a two-input inclusive-OR module with a fan-out capability of three with any desired logical positive and negative combination. The system involves the use of some 325 modules, each of which contains two magnetic multiaperture devices (MAD's). This paper (Part I) gives a complete description of the circuit and physical arrangement of the machine. The system is controlled from a manual keyboard, and readout from the machine is via incandescent lamps controlled directly from the MAD elements. Logical synthesis techniques and system design are discussed in Part II (see Ref. 1608). 9 refs.

1608 **Design of an all-magnetic computing system: Part II—Logical design.** H. D. Crane, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 221-232. In this paper, a logical design technique is developed for use with the module described in Part I (see Ref. 1607). The module performs the (inclusive) OR function of two input variables. This function can subsequently be transmitted to three receivers, each transfer being independently logically positive or negative. The readouts are nondestructive and the transmitter module must be explicity cleared before readin is again possible. In view of the relatively small fan-in and fan-out of this module, and since only the OR function can be directly formed during any single transfer, complex logic functions must be formed slowly, a step at a time. This step-by-step generation of functions results in the need for more modules than might otherwise be required. The design of the decimal arithmetic unit referred to in Part I is outlined. Some comparisons are noted between this particular all-magnetic scheme and conventional core-diode schemes. Comparisons are also made between magnetic logic schemes in general and other schemes such as ac-operated parametrons and conventional transistor systems. 9 refs.

1609 **A generalization of a theorem of Quine for simplifying truth functions.** J. T. Chu, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 165-168. A method of Quine for identifying the core prime implicants of a given truth function, without obtaining all its prime implicants, is generalised under the so-called 'don't care' conditions. It is shown that the method is equivalent to, and sometimes an improvement of, a result of Roth. When all the prime implicants (under the don't care conditions) of a truth function are given, the method becomes a generalisation of a result of Ghazala and is equivalent to another result of Roth. It is also pointed out that the method may be used, in a way similar to using Roth's, for simplifying truth functions. 6 refs.

1610 **On the size of weights required for linear-input switching functions.** J. Myhill and W. H. Kautz, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 288-290. This letter is concerned with the maximum size of the weights which may be required for the realisation of arbitrary linear-input functions. It is shown that it is necessary to be prepared for rather large weights, approaching a value which grows at a rate no less than $2^n/n$ for an n-input device, as n becomes large. This suggests that if the nature of the device imposes any restrictions on the maximum size of input weights, this will probably increase substantially the number of such devices required for the realisation of arbitrary switching functions. 7 refs.

1611 **Some recent papers on threshold logic.** R. O. Winder, *Proc. IRE,* **49,** June 1961, 1100. Letter suggesting basic notation for threshold logic and surveying recent papers on the subject. 12 refs.

1612 **Bilateral switching using nonsymmetric elements.** M. Aoki and G. Estrin, California University, Los Angeles, *PB 149816,* May 1960, 55 p. Magnetic core memory elements characteristically require bipolar applied fields. The vanishing inner diameter of toroids and the loss of the third dimension entirely in deposited thin films demands minimisation of the number of wires. A configuration which has been investigated and applied in a word organised memory is illustrated. It consists of a pair of mutually inverted and parallel connected transistors. The transistors are not in general symmetrical. Some of the system considerations which determine the important design parameters are discussed. Methods for location of regions of satisfactory operation in the many-variable space of the inverted transistor pair are described. Attention is focussed on the question: 'What classical and new procedures can be used to reduce the number of dimensions in such design problems?' The power of computers as a design tool is crucially dependent upon such processes. 3 refs.

1613 **Computer design using index arithmetic.** A. S. Fraenkel, California University, Los Angeles, *PB 149138,* May 1960, 11 p. A system in which the two numbers entering a multiplication are transformed into indices is considered. These indices are added in their own number system. The sum, when converted back, gives the product. Multiplication is replaced by the faster process of addition; a^n may be computed by the single operation of multiplying the index of a by n. Using indices, which are integers, the product is exact, which is not generally true for logarithms. The difference of two indices corresponds to the quotient only when the latter is an integer. No easy way has been found for performing division in other cases. Properties of indices corresponding to Mersenne primes are derived and used to save mechanisation or storage requirements for the conversion of numbers into indices or vice versa. For a computer with a large word length, the required storage is still extensive. 9 refs.

1614 **Improvement of electronic computer reliability through the use of redundancy.** J. Tierney and R. Wasserman, Hermes Electronics Co., *PB 154087,* 15 April 1960, 38 p. Within certain reasonable bounds, the use of redundant elements in complex digital systems can improve reliability substantially. In particular, a 'majority' type of redundant design can improve the reliability of a logical net under certain reasonable physical restrictions. The digital systems to which this report is directed operate under the following conditions: (1) Operating interval is sufficiently long or the system is so complex that the probability of successful operation is less than that called for by the application. (2) The system is unserviceable during the pertinent time interval for economic, physical or strategic reasons. (3) Equipment cost and size are of secondary design importance (although order of magnitude increases are certainly undesirable). 2 refs.

1615 **Checking circuitry.** Int. Business Machines Corp., *U.S.P. 2970764,* 7 Feb. 1961. This patent describes circuitry for checking whether a multi-decimal position word expressed in binary-decimal and the indicator or indicated bit count (defined as the 3's complement of the bit count modulo 4) of the word are in accord.

1616 **Complementing circuitry.** Int. Business Machines Corp., *U.S.P. 2972137,* 14 Feb. 1961. Circuitry is described for providing alternatively either the true form or the two's complement form of a binary word according to the binary value of a control digit which precedes the word.

1617 **Error detecting and correcting circuitry.** Minneapolis-Honeywell Regulator Co., *U.S.P. 2977047,* 28 March 1961. A system for detecting and correcting errors by means of check bits representing selective summings of bits in information groups, is described.

See also :—
Elements, Refs. 1671, 1678 and 1679.

LEARNING AND PATTERN RECOGNITION

1618 **Autocorrelation pattern recognition.** R. Y. Kain, *Proc. IRE,* **49,** June 1961, 1085-1086. Letter referring to 'Pattern recognition using autocorrelation', L. P. Horwitz and G. L. Shelton, *ibid,* **49,** Jan. 1961, 175-185 (*C.A.,* **5,** April 1961, Ref. 678) and describing some work done in the same area by the author. He made use of several 'ideals' (e.g. different type founts) for definition of the patterns and the ratio of the mean to standard deviation of the autocorrelation functions of the samples was used for identification. Experiments on the TX-O computer are outlined. 3 refs.

1619 **Computer simulation of human thinking and problem solving.** H. A. Simon and A. Newell, *Datamation,* **7,** June and July 1961, 18-20 and 35-37. A somewhat longer version of, but basically the same as, the article appearing in *Computers & Automn.,* **10,** April 1961, 18-19, 22-24, 26 (*C.A.,* **5,** June 1961, Ref. 1107).

1620 **Minimal characterizing experiments for finite memory automata.** J. E. Mezei, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 288. Letter referring to 'Characterizing experiments for finite-memory binary automata', A. Gill, *ibid,* **EC-9,** Dec. 1960, 469-471 (*C.A.,* **5,** Feb. 1961, Ref. 235), and in which the relationship between finite memory automata and the corresponding minimal characterising experiments is made more explicit. 2 refs.

1621 **A note on Moore's Distinguishability Theorem.** A. Gill, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 290-291. This letter is concerned with the theorem in E. F. Moore's 'Gedanken experiments on sequential machines', which states: If M_1 is an n_1-state machine and M_2 an n_2-state machine, such that some state q_i of M_1 is distinguishable from state q_j of M_2, then the bound on the length L of the distinguishing experiment is given by $L \leq n_1+n_2-1$ where the upper bound is achievable with equality. A proof is presented that $L \leq n_1+n_2-1$ is achievable with equality. 4 refs.

1622 **A note on optimum pattern recognition systems.** W. H. Highleyman, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 287-288. Letter in which it is shown that minimising the cost function of a pattern recognition system in the case of constant costs, also minimises the error rate for a fixed rejection rate. 2 refs.

1623 **On the state assignment problem for sequential machines. I.** J. Hartmanis, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 157-165. In this paper, the problem of determining economical state assignments for finite-state sequential machines is studied. The fundamental idea is to find methods for selection of these assignments in which each binary variable describing the new state depends on as few variables of the old state as possible. In general, these variable assignments in which the dependence is reduced yield more economical implementation for the sequential machine than the assignments in which the dependence is not reduced. The main tool used in this study is the partition with the substitution property on the set of states of a sequential machine. It is shown that for a sequential machine the existence of assignments with reduced dependence is very closely connected with the existence of partitions with the substitution property on the set of states of the machine. It is shown how to determine these partitions for a given sequential machine and how they can be used to obtain assignments with reduced dependence. 7 refs.

1624 **Adaptive switching circuits.** B. Widrow and M. E. Hoff, Stanford University, *PB 150227,* 30 June 1960, 40 p. An adaptive pattern classification machine (called ADALINE for adaptive linear) has been devised to illustrate adaptive behaviour and artificial learning. During a training phase, crude geometric patterns are fed to the machine by setting the toggle switches in a 4×4 input array. Setting another toggle switch tells the machine whether the desired output for the particular pattern is $+1$ or -1. All input patterns are classified into two categories. The system learns a little from each pattern and accordingly experiences a design change. After training, the machine can be used to classify the original patterns and noisy (distorted) versions of these patterns. At present the purely mechanical adaption process is accomplished by manual potentiometer setting. A means of automating this is being developed which makes use of multi-aperture ferromagnetic devices. Solid-state adaptive logical elements will result that should ultimately be suitable to be microminiaturised. Networks of such elements would be very effective in pattern recognition systems, information storage and retrieval-by-classification systems, and self-repairing logical and computing systems. 18 refs.

1625 **Character recognition and photomemory storage devices feasibility study.** D. M. Baumann, F. T. Brown et al., M.I.T., *PB 147787,* 1960, 78 p. A study was conducted to determine the feasibility of high speed photoelectric scanning of printed material. The desired goal is to develop a system that will scan and encode printed matter in a fashion suitable for digital computer input. Photoelectric character recognition, related optics and photomemory development are discussed. A theory of weighted area scanning is presented which yields an analogue voltage by means of a photocell. 2 refs.

1626 **Regular canonical systems and finite automata.** J. R. Buchi, Michigan University, *PB 152135,* Dec. 1959, 28 p. Regular canonical systems, whose rules of production are of the form, $ax \longrightarrow bx$, are discussed. Regular systems are interesting because they produce only recursive sets of words, but not all recursive sets of words (diagonal argument). The main result states that only a very simple kind of set of words is generable by regular systems, namely, the regular sets of behaviours of finite automata. To a finite automaton with binary output, a system Φ of regular productions can be adjoined with an axiom U in such a way that an input word x is detected by the output of the automaton just in case x is Φ-deducible from U, i.e. the set of words generated by Φ from U is the behaviour of the finite automaton with binary output. The following converse is asserted: the set of words generated by any regular system from a finite set of axioms is the behaviour of some finite automaton with binary output. 10 refs.

1627 **Weak second-order arithmetic and finite automata.** J. R. Buchi, Michigan University, *PB 150726,* Sept. 1959, 47 p. A conventional formalism, a weak second-order arithmetic, is derived to replace the formalism of regular expressions as introduced by Kleene. Theorems which are equivalent to Kleene's synthesis and analysis theorems are presented. This result is of interest for automata theory because formulae of weak second-order arithmetic seem to be more convenient than regular expressions for formalising conditions on the behaviour of automata. 15 refs.

1628 **Character recognition.** Standard Telephones & Cables Ltd., *B.P. 871162* and *871163*, 21 June 1961, These two patents are concerned with character recognition equipment in which signals produced by scanning of a character are stored in a two-dimensional shift register having storage cells in the same arrangement as the raster elements of the scanning field; the stored signals are evaluated by circuits connected to the individual storage cells.

See also :—
Accessories, Ref. 1655.

MATHEMATICS

1629 **Chebyshev semi-iterative methods, successive overrelaxation iterative methods, and second order Richardson iterative methods.** (Part I and Part II.) G. H. Golub and R. S. Varga, *Numerische Mathematik,* **3,** 24 March and 23 June 1961, 147-156 and 157-168. This paper compares the three systematic iterative methods of the title in their application to primitive and to cyclic matrices. 27 refs.

1630 **Dégénérescence dans les approximations de Tschebyscheff linéaires et discrètes.** (Degeneration in linear and discrete Chebyshev approximations.) J. Descloux, *Numerische Mathematik,* **3,** 23 June 1961, 180-187. (In French) Chebyshev approximation in the case of non-degenerate problems has been studied with the aid of an exchange algorithm by E. Steifel. In this paper, his results are generalised. After discussing some properties of approximations in the degenerate case, a generalized exchange algorithm is presented. 4 refs.

1631 **Ein Differenzenverfahren zur näherungsweisen Lösung des Anfangswertproblems für Systeme halblinearer partieller Differentialgleichungen 1. Ordnung.** (A difference method for approximate solution of initial value problems for systems of semi-linear, first order partial differential equations.) R. Albrecht and W. Urich, *Numerische Mathematik,* **3,** 24 March 1961, 131-146. (In German.)

1632 **Zur Fehlerabschätzung für die numerische Eigenwertbestimmung bei Integralgleichungen.** (On error estimation for the numerical determination of eigenvalues of integral equations.) H. Brakhage, *Numerische Mathematik,* **3,** 23 June 1961, 174-179. (In German.) 7 refs.

1633 **Fehlerabschätzungen bei Relaxationsverfahren zur numerischen Auflösung linearer Gleichungssysteme.** (Error estimation in relaxation methods for numerical solution of linear systems of equations.) J. Albrecht, *Numerische Mathematik,* **3,** 23 June 1961, 188-201. (In German.) 16 refs.

1634 **Jordan-Elimination und Ausgleichung nach kleinsten Quadraten.** (Jordan elimination and least squares fitting.) P. Läuchli, *Numerische Mathematik,* **3,** 23 June 1961, 226-240. (In German.) 8 refs.

1635 **Monotonie und Extremalprinzipien beim Newtonschen Verfahren.** (Monotony and extremal principles with Newton's method.) L. Collatz, *Numerische Mathematik,* **3,** 24 March 1961, 99-106. (In German.)

1636 **Note on the numerical integration of periodic functions and of partially periodic functions.** L. C. Hsu, *Numerische Mathematik,* **3,** 23 June 1961, 169-173. It is shown that error estimation for an ordinary approximation formula for periodic functions of several variables may be directly attained by means of the Euler-Maclaurin summation formula. The paper is also concerned with the problem of reducing the numerical integration of partially periodic functions of several variables to that of functions with less variables. 10 refs.

1637 **A stagewise parameter estimation procedure for correlated data.** M. Blum, *Numerische Mathematik,* **3,** 23 June 1961, 202-208. Given a set of N observations consisting of a deterministic function or mean value function

$$f(t) = \sum_{j=0}^{k} A_j h_j(t)$$

plus a random stationary error $\xi(t)$ where the functions $h_j(t)$ are known a priori but the parameter vector $A=(A_0,A_1 \ldots, A_k)$ is unknown, the central problem is to obtain an optimum estimate of A. In this paper, a stagewise estimation procedure for A, developed by P. Swerling, is extended to a more general class of correlated data. 5 refs.

1638 **Verbesserung einer Fehlerabschätzung für gewöhnliche Differentialgleichungen erster Ordnung.** (Improvements in error estimation for ordinary differential equations of the first order.) J. Schröder, *Numerische Mathematik,* **3,** 24 March 1961, 125-130. (In German.)

1639 **Der Wert einiger Konstanten in der Theorie der Approximation mit Bernstein-Polynomen.** (The values of some constants in the theory of approximation with Bernstein polynomials.) P. C. Sikkema, *Numerische Mathematik,* **3,** 24 March 1961, 107-116. (In German) Values are presented for constants involved in approximation by Bernstein polynomials. 3 refs.

1640 **An iterative solution of large scale systems of simultaneous linear equations.** F. J. Bellar, University of Maryland, *PB 147904,* May 1960, 11 p. An algorithm proposed by Lanczos for the generation of an approximate solution of a large scale system of simultaneous linear equations is improved so that the number of iterations required for a desired degree of accuracy is minimised. 3 refs.

TECHNIQUES

1641 **Application of the method of the kernel function for solving boundary-value problems.** S. Bergman and J. G. Herriot, *Numerische Mathematik,* **3,** 23 June 1961, 209-225. This paper is concerned with the application of the kernel function method to the digital computer solution of boundary value problems, the discussion being limited to Laplace's equation. As an example of the solution of Laplace's equation, a harmonic boundary value problem for an 8-fold symmetric star-shaped domain is considered, and details are given of results obtained on a Burroughs 220. The complete program is presented in ALGOL 60. For a domain with 8-fold symmetry, the program constructs a set of orthonormal functions and then uses them to find an approximation to the solution of a harmonic boundary value problem. It also calculates the mapping of the domain onto a circular region. 15 refs.

1642 **Application programs available.** E. C. Berkeley, *Computers & Automn.,* **10,** June 1961, 138. The names and addresses are listed of 16 U.S. organisations who have programs which they are willing to make available to other people. No information whatsoever is given about the programs.

1643 **Digital computer programs analog solutions.** T. H. Witzel and J. L. Wilson, *Control Engng.,* **8,** June 1961, 135-138. Account of the programming of a digital computer to list standard analogue computing components together with interconnections and gain settings for a general though limited class of differential equations. The printed list is easily translated into an analogue computer schematic for a particular problem. An example for Volterra's equations is given.

1644 **On the encoding of arbitrary geometric configurations.** H. Freeman, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 260-268. A method is described which permits the encoding of arbitrary geometric configurations so as to facilitate their analysis and manipulation by means of a digital computer. It is shown that one can determine through the use of relatively simple numerical techniques whether a given arbitrary plane curve is open or closed, whether it is singly or multiply connected, and what area it encloses. Further, one can cause a given figure to be expanded, contracted, elongated or rotated by an arbitrary amount. It is shown that there are a number of ways of encoding arbitrary geometric curves to facilitate such manipulations. One method, the so-called rectangular array type of encoding, is discussed in detail. In this method the slope function is quantised into a set of eight standard slopes.

1645 **On-line processing.** S. C. Blumenthal, *Datamation,* **7,** June 1961, 23-24. This article discusses the on-line use of digital systems in such areas as traffic control, banking, process control, military application, inventory control, etc. The requirements imposed on program design are considered and an approach to the problems is presented.

1646 **Programm fur das Adams'sche Verfahren, numerischer Vergleich mit Runge-Kutta nach vielen Integrationsschritten.** Program for Adams method, numerical comparison with Runge-Kutta according to many integration steps). H. Posch, *Elektronische Datenverarbeitung,* No. 2, 1961, 49-71. (In German) This paper deals at some length with the programming for the Siemens 2002 of Adams method for the numerical solution of simultaneous differential equations and also compares the results with those obtained by the Runge-Kutta method. After an account of the Adams method, the procedure is described in algorithmic language and flow charts are given. The coding of the program in the original Siemens orders is presented and the program description, providing all necessary information for the use of the program, is given in the special form developed by the Hahn-Meitner-Instituts für Kernforschung, Berlin.

1647 **Reducing computing time for synchronous binary division.** S. G. Saltman, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 169-174. It is shown that the computing time for binary division is shortened by performing division, radix 2^p on the binary operands, where p is a positive integer. Each quotient digit radix 2^p is computed in almost the same time required to determine a binary quotient digit. Therefore, computing time is reduced by approximately the factor p over conventional binary division. The method is most useful for synchronous machines but can be applied to either serial or parallel operation. The theory of nonrestoring division in any integral radix is discussed. An arrangement of components for a serial computer and a sample division for radix 4 are given. 6 refs.

1648 **Scaling and information transfer in combined analog digital computer systems.** G. Birkel, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 8 p. General discussion of programming and scaling in the data link of a combined analogue digital computer system. 9 refs.

1649 **Problems solved on high-speed computing equipment of the Applied Mathematics Laboratory.** H. Smith and L. Acton, David Taylor Model Basin, Washington, D.C., *PB 155578,* Jan. 1959, 68 p. A total of 118 problems have been programmed. These problems fall into two general categories: naval engineering and management data analysis. This report contains a complete list and brief descriptions of the problems.

See also :—
Mathematics, Refs. 1629 and 1637.
Applications: Simulation, Ref. 1796*f*.

ACCESSORIES

1650 **An analog digital computer linkage system for use with the Bendix G-15D.** R. E. Wright and W. Henn, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 20 p. This paper outlines the design of an Epsco ADDAVERTER system designed for coupling the Bendix G-15D digital computer to an analogue computer and describes its operation when used to link a G-15D to an Electronic Associates Model 16-131R analogue computer. 3 refs.

1651 **Error statistics and coding for binary transmission over telephone circuits.** A. B. Fontaine and R. G. Gallager, *Proc. IRE,* **49,** June 1961, 1059-1065. In this paper, about 2,000 hours of noise data on various digital data telephone links are analysed with respect to the applicability of coding theory to such links. The analysis indicates that coding for error correction is inefficient for such systems, but that coding for error detection, along with feedback, is remarkably simple and effective. 11 refs.

1652 **A general-purpose analog-digital computer system.** M. L. Stein, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 11 p. This paper is concerned with the combined analogue digital computer system of the University of Minnesota. The system consists of a UNIVAC Scientific 1103, a Reeves analogue computer and the Electronic Associates ADDALINK which enables the two computers to operate simultaneously, exchanging information in both directions. The paper describes the ADDALINK and its operation. 6 refs.

1653 **High-speed analog-to-digital converters utilizing tunnel diodes.** R. A. Kaenel, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 273-284. This paper describes two analogue-to-digital sequential converters which combine in one tunnel diode pair per bit the functions of an amplitude discriminator and memory. In addition, one of the two circuits utilises each tunnel diode pair as a delay network. The conversion duration of one of these six-bit converters, which employs germanium 2N559 transistors and gallium arsenide 1N651 tunnel diodes, has been set to 1 microsecond. A bibliography of 55 references relating to tunnel diode switching circuits is included.

1654 **High speed data systems solves low level signal problems.** W. F. Kamsler, *Auto. Control,* **14,** June 1961, 37-44. Description, in some detail, of a high speed digital data acquisition system designed by Epsco-West and used at Lockheed's Missiles and Space Division Satellite Systems Test Facility to monitor and record the progress of design activities. The system is capable of handling 200 channels from any of three sources: strain gauge bridges, thermocouples, and miscellaneous millivolt signals. Recording is effected at a 5,000 or 10,000 data samples per second rate on magnetic tape. Editing facilities are provided to transcribe the initial magnetic tape recordings into a second magnetic tape with a format acceptable to either IBM 704 or 709 computers.

1655 **The place of character recognition, data transmission and document handling in an ADP system.** D. P. Kilner, *Computer Bull.,* **5,** June 1961, 19-24. A report on a conference held on Character Recognition, Data Transmission and Document Handling, 27-29 March 1961, by the Northampton College of Advanced Technology, London, in co-operation with the British Computer Society. The general conclusion would appear to be that progress depends to a large extent on clarifying aims for the three fields covered by the conference.

1656 **Some aspects of computer linkage system design.** W. J. Peet and D. A. Baumann, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 25 p. Types of problems for which combined analogue-digital computer operation can be profitably employed are briefly considered. One such problem, namely simulation of a missile flight, is discussed in detail from the point of view of the factors which influence combined operation. The factors to be considered in specifying a computer linkage system are listed and discussed. Three ADDALINK systems designed and constructed by Electronic Associates Inc., are then described. These are: (1) The 4.033 ADDALINK for IBM's Research Laboratory, which links an IBM 704 and a PACE analogue computer; (2) The 4.077 ADDALINK for the University of Minnesota, which links an ERA 1103A and an analogue computer; (3) The 4.091 ADDALINK for Douglas Aircraft Company, which links a Bendix G-15 to an analogue computer.

1657 **Timing considerations in a combined simulation system employing a serial digital computer.** E. Hartsfield, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 10 p. A combined analogue-digital system is being developed at Space Technology Laboratories, Inc., for the simulation of complex missile control systems. The system employs a PACE analogue computer, a Packard Bell PB 250 digital computer and an Epsco ADDAVERTER. This paper deals with the synchronisation problems that arise when a serial digital computer is used for combined simulation purposes and the techniques used in the above system to handle them. Use is made of the Sample-Present Timer, a two channel digital timer that is independent of both the analogue and digital computers. Essentially, the timer makes it possible to vary manually the sampling rate and the feedback delay interval over a range consistent with the time required for a digital program cycle. 2 refs.

1658 **Machine languages translation devices system.** J. F. McCarthy and J. F. McKenna, Anderson-Nichols & Co., *PB 155030,* 21 July 1959, 53 p. A complete coverage of the scope of the development programme for the Machine Language Translation Devices System is contained in this report. It includes a complete phase breakdown of each of the tasks of the over-all development programme including the development engineering for the Militarized High Speed Page Printing System, the Code Conversion System, the Keyboard Input Units, and the results of the investigations for the Integration of the Magnetic Tape Units, the High Speed Photoelectric Paper Tape Reader, and the Militarized Digital Communications Kineplex System.

1659 **Shaft-angle digitizing and recording system.** E. Nadalin, Naval Ordnance Test Station, China Lake, California, *PB 153647,* Nov. 1960, 65 p. A system is reported for recording simultaneously in digital form the range, azimuth and elevation parameters of target position in relation to radar position together with range timing, on magnetic tape in an IBM 709 tape format. The parameters are digitised by means of shaft-angle encoders. This data is stored in a magnetic core memory by means of transistorised logic circuitry and then shifted onto magnetic tape. The data is then in a format for direct entry into the IBM 709.

1660 **Checking circuitry.** Minneapolis-Honeywell Regulator Co., *U.S.P. 2971056,* 7 Feb. 1961. This patent discloses a digital operation checking circuit which checks the performance of a circuit used in the transfer and conversion of data to a printer or similar apparatus.

1661 **Code converter.** Burroughs Corp., *U.S.P. 2972135,* 14 Feb. 1961. Circuits are described for generating binary-coded signals according to four-, eight- and ten-digit input codes.

1662 **Magnetic recording of data.** Laboratory for Electronics, Inc., *U.S.P. 2972735,* 21 Feb. 1961. This patent is concerned with arrangements for reading data from a magnetic drum or the like without use of an external timing source.

1663 **Data recording.** Int. Business Machines Corp., *U.S.P. 2975407,* 14 March 1961. This patent describes arrangements for recording data on a medium such as magnetic tape, in which errors in data recorded on a defective area of the medium are detected, the data is erased and re-recorded on a new area.

See also :—
Design, Ref. 1605.

ELEMENTS

1664 **An accurate analog multiplier and divider.** E. Kettel and W. Schneider, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 269-272. This paper describes a time-division multiplier and divider employing transistor switches. In a time-division multiplier the product x_1x_2 is formed by pulse-duration modulation with x_1 and amplitude modulation with x_2. The circuit can be arranged in such a manner that division by means of a quantity x_3 can be carried out simultaneously, the output being x_1x_2/x_3. When transistor switches are employed the error is 1×10^{-4} machine units only. The zero error for x_2, used for amplitude modulation, can be reduced to 2×10^{-5} machine units. 4 refs.

1665 **Analysis of a crossed-film cryotron shift register.** H. H. Edwards, V. L. Newhouse and J. W. Bremer, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 285-287. Letter presenting a new mode of the crossed-film cryotron shift register described in the authors' paper 'An improved film cryotron and its application to digital computers', *Proc. IRE,* **48,** Aug. 1960, 1395-1404 (*C.A.,* **5,** March 1961, Ref. 521). In addition, the criteria of operation are analysed, the time constant and maximum speed of operation are calculated and the experimentally observed outputs are given.

1666 **Bibliography on magnetostrictive delay lines.** A. Rothbart, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 285. Letter presenting a bibliography of 37 references relating to the theory, design and application of magnetostrictive delay lines.

1667 **Components of automatic computing machinery—list of types.** *Computers & Automn.,* **10,** June 1961, 131-132. List of types of components of automatic machinery for computing or data processing arranged under five main headings: storage mediums, for both internal and external storage; storage mediums, internal only; calculating and controlling devices; input devices; output devices.

1668 **Esaki diode NOT-OR logic circuits.** H. S. Yourke, S. A. Butler and W. G. Strohm, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 183-190. A basic technique is presented which enables the development of Esaki diode NOT-OR (NOR) logic circuits. Two embodiments of the basic scheme are discussed, which, when combined with an OR-DELAY circuit, provide a logically complete system. A tolerance analysis is included, which demonstrates that the technique enables the practical design of logic circuits. The requirements placed on Esaki diode characteristics and the speed limitations of the circuits are discussed. Examples of working circuits are shown, including photographs of voltage wave shapes. 3 refs.

1669 **High-speed switching with the tetrode transistor.** C. R. Cook and J. Luecke, *Control Engng.,* **8,** June 1961, 118-121. Tetrode action of a transistor with two base connections is explained and a high speed current mode flip-flop employing tetrode transistors is described. The use of the flip-flop in a binary counter is also described. 1 ref.

1670 **Linear-segment hybrid function generators.** H. Schmid, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 21 p. The combination of analogue and digital computing techniques permits the design of a linear-segment diode function generator with very high repeatability and relatively high speed. This paper gives system descriptions of the function generator with digital input and digital output, with digital input and analogue output, and with analogue input and analogue output. A circuit description is given of a version of the latter type of hybrid function generator which has been built and tested. Static and dynamic performances are discussed. 2 refs.

1671 **Logic circuits using square-loop magnetic devices: a survey.** J. L. Haynes, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 191-203. This paper reviews techniques which have been suggested for using magnetic circuits for digital computer logic and control functions. There is a brief introductory discussion of magnetic circuit relationships and the terminology used in the survey. The remainder of the paper consists of a summary of 24 square loop magnetic logic circuits which have been proposed or developed, with a brief description of the way each circuit or circuit family meets the requirements of logic circuitry. The generic relationships among circuits are stressed. The circuits are discussed under four main headings: core-diode schemes; core-transistor schemes; core-capacitor scheme; all-magnetic schemes. 61 refs.

1672 **Magnetic cores, characteristics and applications.** R. Stuart-Williams, *Auto. Control,* **14,** June 1961, 54-57. The third in a series of articles (for others see *C.A.,* **5,** Refs. 1205 and 1460) designed to provide reference material for engineers concerned with the design and application of magnetic core storage and switching units. This article is concerned with magnetic core switching techniques as employed to drive selection wires of a coincident current core matrix.

1673 **Matrix switch and drive system for a low-cost magnetic-core memory.** W. A. Christopherson, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 238-246. This paper describes the organisation, design and operation of a ferrite core matrix switch and drive system developed for a low cost magnetic core memory. The memory, made of seven 100×100 memory-core planes identical to those used in the IBM 7070 and 1620, uses coincident current techniques and has a capacity of 10,000 characters with seven bits per character. A 20 microsecond read-compute-write cycle features serial-by-character processing. The matrix switch requires only two sets of five drivers to select one out of 100 individual outputs. The drivers operate in an unusual three-out-of-five coding arrangement. A Set and a Reset driver, each using four transistors in parallel, are also required for the matrix switch. Two matrix switches provide the 200 X-Y half-select drives for the 100×100 seven-plane core array. 7 refs.

1674 **A 2.18-microsecond megabit core storage unit.** C. A. Allen, G. D. Bruce and E. D. Councill, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 233-237. This paper is concerned with the IBM 7302 Core Storage, a large magnetic core memory developed as part of a programme for high speed memories for STRETCH; it is also used, with logic modifications, in the IBM 7080 and 7090. The memory has a cycle time of 2.18 microseconds and an access time of 1 microsecond. It uses ferrite toroids and is a coincident-current, three-dimensional system; 16,384 words of 72 bits each are addressable by random access in a single array of 1,179,648 cores. The array configuration and the design of the driving system are described. The core and transistor requirements are discussed and a description is given of the sensing and driving circuitry. Design factors which governed the choice of the three-dimensional system organisation are presented. 4 refs.

1675 **Serial matrix storage systems.** M. Lehman, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 247-252. Coincident-current techniques, usually associated with parallel ferrite core stores, may also be used for the operation of serio-parallel or purely serial memories. After outlining, in block diagram form, one possible physical realisation of a serial system, this paper examines the conditions under which such a store is economically justified. The distinguishing feature of the system discussed is that coincidence is established in the memory matrix between two currents representing an address signal and a time signal,

respectively. It is shown how the properties of the time-controlled serial store may lead to the adoption of a word-asynchronous design for serial digital computers. In such a machine, timing is not controlled or determined by limited store access. As examples, the paper indicates how the serial techniques facilitate the incorporation into small serial computers of autonomous transfers, automatic floating point operations, high speed multiplication, division and shift orders, and asynchronous transfers between, say, a high speed store and a magnetic drum. 16 refs.

1676 **A straightforward way of generating all Boolean functions of N variables using a single magnetic circuit.** K. V. Mina and E. E. Newhall, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 151-156. A correspondence has been established between the topology of relay contact networks and the topology of magnetic circuits, which may be applied to a relay tree to produce a magnetic structure capable of generating, in a simple manner, all Boolean functions of N variables. Once the basic magnetic topology is established, it may be distorted to achieve winding simplicity at the expense of magnetic circuit complexity. In the resulting arrangement, the drive, hold (variable) and reset windings are always in the same position, regardless of the function to be generated. Any one of the 2^{2^N} functions of N variables is generated by linking a selected group of the output legs. Experimental structures and their operation are described and experimental results are discussed. 2 refs.

1677 **Device requirements for a large cryosar memory.** R. C. Johnston, M.I.T., *PB 153905,* 27 Dec. 1960, 9 p., 3 refs.

1678 **Neuristor.** H. D. Crane, Stanford University, *PB 153785,* 16 March 1960, 11 p. A novel device and its properties are hypothesised and possible digital systems employing it are briefly outlined. The devices, termed neuristors, may be used to synthesise all digital logic functions, so that any digital logic system can be realised using arrays of neuristors only.

1679 **Research on multi-aperture magnetic logic devices.** D. R. Bennion, Stanford Research Institute, *PB 148231,* May 1960, 95 p. Methods are presented for describing and measuring the properties (static and dynamic) of magnetic materials, devices and circuits. A new approach to the development of practical switching models is introduced, for use in the analysis of flux transfer in all-magnetic circuits. Various means are discussed for realising an OR-NOR logic module with one or more multi-aperture devices, alone or in conjunction with toroids. One such module makes use of a pair of PLUS-MINUS devices (components that can be wired for either direct or complementary transfer of information). It is concluded that this particular approach to all-magnetic logic is a sound one. 13 refs.

1680 **Analogue-digital multiplier.** Associated Electrical Industries Ltd., *B.P. 869822,* 7 June 1961. A circuit for multiplying two quantities, one in analogue and the other in digital form, comprises a high gain dc amplifier, and a number of resistors and a switching arrangement whereby the ratio of feedback/input resistance can be varied in discrete, digital steps.

1681 **Binary storage circuit.** A. V. Roe & Co., Ltd., *B.P. 869862,* 7 June 1961. A circuit suitable for the short term storage of binary data and which consumes little power, includes a diode, a capacitor and a transistor.

1682 **Function generator.** Gen. Electric Co., Ltd., *B.P. 870063,* 14 June 1961. A function generator designed for use with a sine or other trigonometric function generator and which converts an angle lying outside the range of the latter generator to one lying within the range and having the same value of the trigonometric function as the original angle.

1683 **Data storage matrix.** Standard Telephones & Cables Ltd., *B.P. 871632,* 28 June 1961. A storage matrix is described which has improved arrangements for inhibiting noise pulses induced in output wires by reading pulses.

1684 **Magnetic core circuitry for serial storage of binary data.** Zuse K.-G., *B.P. 871714,* 28 June 1961. Binary data is serially stored in a magnetic core matrix with the aid of a magnetic core counting chain.

1685 **Binary multiplier.** Burroughs Corp., *U.S.P. 2970766,* 7 Feb. 1961. This patent describes a binary multiplier which does not employ column shift or repeated addition, but achieves high speed by the use of a magnetostrictive delay device.

1686 **Binary adder.** Int. Business Machines Corp., *U.S.P. 2971696,* 14 Feb. 1961. A binary adder circuit is described which makes use of a transistor having an asymmetrically conductive base electrode to provide it with very high current gain characteristics.

1687 **Logic elements.** Sperry Rand Corp., *U.S.P. 2972060,* 14 Feb. 1961. This patent describes a comparatively simple logical circuit which employs a pulse transformer and a transistor and provides both direct and complement outputs.

1688 **Binary counter.** Bell Telephone Labs., Inc., *U.S.P. 2972062,* 14 Feb. 1961. A binary counter is described which employs two junction transistor tetrodes with bases and collectors cross-coupled to form a bistable multivibrator, trigger pulses being applied to each collector via a diode.

1689 **Magnetic core storage matrix.** Bell Telephone Labs., Inc., *U.S.P. 2972130,* 14 Feb. 1961. A magnetic core matrix is provided with a read-out arrangement designed to reduce the spurious output signals produced by non-selected cores in the readout signal.

1690 **Analogue multiplier.** Gen. Precision Inc., *U.S.P. 2973146,* 28 Feb. 1961. A four-quadrant time-division multiplier is described which makes use of transistor switching circuits.

1691 **Ring counter.** Burroughs Corp., *U.S.P. 2973438,* 28 Feb. 1961. A ring counter comprises transistor bistable circuits between which are transistor conditional steering gates.

1692 **Decimal shift register.** Burroughs Corp., *U.S.P. 2973902,* 7 March 1961. A decimal register capable of shifting and/or accumulating words, employs magnetic cores.

1693 **Magnetic core.** North American Philips Co., Inc., *U.S.P. 2974308,* 7 March 1961. A magnetic core with windings arranged for nondestructive readout is described.

1694 **Magnetic core logical circuit.** Burroughs Corp., *U.S.P. 2974309,* 7 March 1961. This patent describes a logical circuit employing magnetic cores for performing the material-equivalence function (i.e., there is an output only when both of the two inputs are the same).

1695 **Inclusive OR element.** Int. Business Machines Corp., *U.S.P. 2974310,* 7 March 1961. A logical circuit for performing the inclusive OR function, which employs magnetic cores but no diodes, is described.

1696 **Shift register.** Int. Business Machines Corp., *U.S.P. 2974311,* 7 March 1961. A high speed shift register employing magnetic cores but no diodes.

1697 **Function generator.** Gen. Precision Inc., *U.S.P. 2975972,* 21 March 1961. A function generator including a resolver and an amplifier with negative feedback, is designed to provide, particularly in navigation systems, the trignometric function

$$E_o = E_i \ (\sec \theta - \tan \theta).$$

1698 **Quarter adder.** Sperry Rand Corp., *U.S.P. 2976425,* 21 March 1961. A quarter adder employing a carrier type magnetic amplifier is described.

1699 **Binary counter.** Gen. Dynamics Corp., *U.S.P. 2977539,* 28 March 1961. This patent discloses a circuit for a binary counter which is operable in either direction by signals of the same polarity.

1700 **Bistable cryotron circuit.** Bell Telephone Labs., Inc., *U.S.P. 2977575,* 28 March 1961. A bistable circuit employs cryotrons with windings connected in specified manner.

ANALOGUE

1701 **Survey of commercial analog computers.** N. Macdonald, *Computers & Automn.,* **10,** June 1961, 117-118, 124. Brief characteristics are given of the following analogue computers: AN/ASN-15 Navigational System (Waldorf Instrument Co.); Card Programmed Diode Function Generator (General Computers Inc.); Desired Generation Computer (Leeds and Northrup Co.); DIAN 60, 120 and 180; Direct Analog Computer (Computer Engineering Associates); Donner 3100; DYSTAC 5800 Iterative Analog Computer (Computer Systems Inc.); EASE 1100 Series; Electronic Associates 221R, 231R and TR-10; ESIAC (Electro Scientific Industries); Gravity Analogue Computer (Seismograph Service Corporation); Philbrick K2, K3, K5 and K7; REAC (Reeves Instrument Corporation).

See also :—
Digital, Ref. 1708.

DIGITAL

1702 **Automatic parallel processing.** S. D. Harper, *Data Processing (Detroit),* **3,** June 1961, 25-26, 29. A simple explanation is given of how automatic parallel processing is effected on the Honeywell 800.

1703 **Descriptions of digital computers.** B. Sheppard, *Computers & Automn.,* **10,** June 1961, 99-113, 116. Details as to internal characteristics, input and output, and cost and use are tabulated for U.S. general purpose digital computers which are currently available. The computers included are: ALWAC III-E; RECOMP II and III; Bendix G-15 and G-20; Burroughs E-101, 205, 220, 251(VRC) and 5000; Clary Corporation DE-60; Control Data 160 and 1604; Digital Equipment Corporation PDP-1; General Electric GE 210 and GE 225; Harvey-Wells Electronics Inc. HW-44K; Honeywell 400 and 800; IBM 305 RAMAC, 650, 704, 705 III, 709, 1401, 1410, 1620, 7070, 7072, 7074, 7080 and 7090; Librascope LIBRATROL 1000 and L-3060; MONROBOT XI; NCR 304, 310, 315 and 390; Packard Bell PB 250; Philco 2000-210, 2000-211 and 2000-212; RCA 301, 501 and 601; Ramo-Wooldridge RW 400 and RW AN/UYK-1; UNIVAC I, II, III, 490, 1103A, 1105, 1107, File Computer I, File Computer II, LARC, and SS 80/90; Royal-McBee LGP-30, RPC 4000 and RPC 9000; Sylvania 9400.

1704 **A hybrid digital differential analyzer-general purpose computer system.** O. A. Reichardt, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 8 p. This paper briefly describes two Packard Bell Computer Corporation computers and then discusses their use in a combined system. The computers are TRICE (Transistorised Real Time Incremental Computer, Expandable), a high speed, parallel, digital differential analyser and the PB 250, a microsecond, general purpose digital computer.

1705 **IBM-RAMAC-Systeme.** (IBM RAMAC Systems). H. Winkler, *Elektronische Datenverarbeitung,* No. 2, 1961, 90-93. (In German) The IBM 1401 RAMAC is outlined and brief mention is made of the IBM 1410 RAMAC and the IBM 7070 RAMAC. An application of the IBM 1401 RAMAC in the textile industry is described.

1706 **The Philips computer PASCAL.** H. J. Heijn and J. C. Selman, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 175-183. This paper gives a general description of PASCAL (Philips Automatic Sequence Calculator), a binary parallel computer with a word length of 42 bits, a clock pulse repetition time of 1½ microseconds, performing on the average 60,000 operations per second.

1707 **Stretch—eine neue Entwicklungsstufe der Datenverarbeitungsmaschinen.** (Stretch—a new stage in the development of data processing machines). A. P. Speiser, *Elektronische Datenverarbeitung,* No. 2, 1961, 76-81. (In German) A general description is given of the main features of STRETCH. 1 ref.

1708 **Survey of special purpose computers and data processors.** N. Macdonald, *Computers & Automn.,* **10,** June 1961, 119-123. Listing of 34 American organisations with brief descriptions of their special purpose analogue and digital equipment (including digital differential analysers). Equipment for a very wide range and large number of different purposes or applications is included.

1709 **Parallel digital computer.** Philips Electrical Industries Ltd., *B.P. 871477,* 28 June 1961. This patent is concerned with a parallel digital computer which has arithmetic arrangements for performing automatically the calculation $x + yz$.

1710 **Parallel binary computer.** Int. Business Machines Corp., *U.S.P. 2974866,* 14 March 1961. This patent provides a comprehensive description of a parallel binary computer, with particular reference to the arrangements for carrying out arithmetic instructions.

1711 **Serial digital computer.** Digital Control Systems Inc., *U.S.P. 2974867,* 14 March 1961. A digital computer is described in which data blocks are stored serially in the main memory thereby reducing both the number of addressing operations and the equipment required for such operations.

PROGRAMMING

1712 **ALGOL employed.** *Data Processing (Detroit),* **3,** June 1961, 32-34. An account of how use is made at the Rich Electronic Computing Center of the Georgia Institute of Technology, of the Burroughs ALGOL compiler to increase programming speed and reduce the cost of commercial work done on their Burroughs 220.

1713 **Computer conversion program.** E. S. Kraft, *Data Processing (Detroit),* **3,** June 1961, 28-29. A brief account of how Philips Electronics Industries Limited of Canada are using punched card equipment for the conversion and assembly of programs written in Symbolic Programming System (SPS) language, to object programs in machine language for an IBM 1401 which is to be delivered in 1962.

1714 **Diagnostic programs for a combined analog-digital system.** K. Feucht, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 20 p. This paper is concerned with diagnostic programs for the combined analogue digital computer system of the General Electric Missile and Space Vehicle Department. The system, described more fully in Ref. 1605, employs an IBM 704, an Electronic Associates 231R analogue computer and HYCOL, the Hybrid Computer Link. The primary purpose of the diagnostic programs is the testing of the transmission and conversion of data between the two computers with and without the selection of a clock frequency.

1715 **Extension to ALGOL.** J. B. Pollard, *Computer Bull.,* **5,** June 1961, 46, 9. Letter suggesting a simple extension to the basic structure of ALGOL 60 which would enable it to deal with matrix, complex, multiple length or any other sort of arithmetic that might be desired.

1716 **A flexible and inexpensive method of monitoring program execution in a digital computer.** F. F. Tsui, *IRE Trans. Electronic Computers,* **EC-10,** June 1961, 253-259. This paper describes a method and equipment for monitoring program execution on the basis of a flow diagram of the program. Equipment has been constructed for monitoring up to 64 boxes in a flow diagram. A subroutine modifies the program as needed for monitoring purposes and restores it to its original form when the user so desires. The monitoring equipment comprises a panel of indicator lamps actuated by logical circuits. The user must provide only a flow diagram on translucent paper in a certain form (which fits over the panel) and the information to correlate this diagram with the program. The monitor can be used to present during the computation a visual dynamic picture of the progress of the program and to register, on occurrence, the whereabouts of an interruption, thus facilitating the tracing of the error.

1717 **Eine Grundprogrammerweiterung für die Z 22.** (An extension of the basic program for the Z 22.) B. Schlender and H. Felsch, *Elektronische Datenverarbeitung,* No. 1, 1961, 20-23. (In German) English summary: 'The basic program of the magnetic drum computer Z 22 at the University of Kiel was enlarged by a number of often used standard programs. The function of this system of programs, its use and its control by a 5-bit-switch-input are described.'

1718 **JOVIAL.** C. J. Shaw, *Datamation,* **7,** June 1961, 28-32. A general introduction is given to the development, advantages and use of JOVIAL, System Development Corporation's procedure-oriented language which is patterned after ALGOL.

1719 **La programmation automatique des formules sur CAB 500.** (Automatic programming of formulae on CAB 500.) D. Starynkevitch, *Elektronische Datenverarbeitung,* No. 1, 1961, 1-5. (In French) This paper describes, with examples, an automatic programming system for the CAB 500 digital computer of Societe d'Electronique et d'Automatisme. The system makes it possible to write down mathematical formulae in their usual form together with a few phrases in plain language, a machine program being then produced by a stored program.

1720 **Die Programmierungsarbeit für die Z 22 bei der Verwendung der "Berliner Organisation".** (Programming operations for the Z 22 by use of the "Berliner Organisation".) K. Freidrich, *Elektronische Datenverarbeitung,* No. 1, 1961, 37-40. (In German) English summary: 'A description is given of the programming system for the Z 22 as used in the Recheninstitut, Technische Universitat Berlin. The article deals with alterations required when introducing this system and demonstrates the way in which this system facilitates the programmer's work in comparison with the standard equipment of the Z 22 as provided by Zuse K.-G. There is a compiler that constitutes the essential part of this system. It uses numbers as symbols for addresses and permits a favourable organisation of subroutines.'

1721 **Programming for a closed-loop, manned-machine combined system.** D. C. Friedman, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 10 p. The use of a digital computer in a real-time closed-loop manned-machine simulation system requires that the program format be of a certain pattern. Because of this, it should be possible to write a program for a general purpose combined analogue-digital system which could be used for widely varying experiments with little or no re-programming. As an example of such a program, this paper presents a program, called ATC-2, written for the combine analogue-digital system (which includes SEAC) at the National Bureau of Standards. The program is intended to handle a variety of experiments dealing with air traffic control by human controllers on the ground.

1722 **ISOPAR, a new and improved symbolic optimizing assembly routine for the IBM 650.** H. H. Howe, Nat. Bureau of Standards, *PB 161577,* 19 July 1960, 112 p.

1723 **Programmers manual for the Oracle compiler.** M. E. LaVerne et al., Oak Ridge National Laboratory, *CF-57-8-92,* 15 June 1959, 39 p.

1724 **The structure of an ALGOL translator.** A. A. Grau, Oak Ridge National Laboratory, *ORNL-3054,* 57 p.

APPLICATIONS

AERONAUTICAL

1725 **Analog computer mechanization of a tilt-wing VTOL aircraft.** E. B. Balsink and D. M. Sovine, Wright-Patterson AFB, *PB 155255,* July 1960, 110 p. The techniques used in simulating a tilt-wing Vertical Takeoff and Landing (VTOL) aircraft are summarised. A 'cockpit' from which the pilot could 'fly' the aircraft was included. Both longitudinal and lateral modes were used, and wing-tilt was possible. Relatively few of the usual linearising assumptions were made, thus it was possible to 'fly' the aircraft through the transition from hover to normal flight and back to hover.

1726 **An analytical method for the classification of flow areas of supersonic wings.** F. M. Mallett, Wright-Patterson AFB, *PB 171593,* Aug. 1960, 109 p. The application of digital computer methods to the calculation of dynamic stability of supersonic aircraft presents the problem of devising a method of computing certain aerodynamic characteristics of the wing or tail alone. These characteristics are necessary in the calculations of wing-body-tail combinations and are of interest in other aspects of aeroplane design. An analysis was made resulting in the complete numerical classification of four basic types of wing planform, of the geometrical cases in each type, and of the subcases resulting from the various patterns of Mach lines within the planform. These cases and subcases are presented together with the analysis that determines them.

1727 **Wallops Island preliminary processing computer programs.** S. M. Ornstein and R. J. Saliga, M.I.T., *PB 154587,* 23 Jan. 1961, 24 p. A portion of the data processing system used to reduce instrumentation data from the Wallops tracking radar is described. Three data acquisition systems (primary, backup and teletype) are processed by the IBM 7090 in a manner which produces a standard format IBM magnetic tape. This tape is then available for such further processing as may be arranged by other groups. In addition, two preliminary output systems (printed output and plotted output) are described which employ the standard format IBM tape as input and employ other programs to obtain printouts and plots. 3 refs.

1728 **West Ford Primary Print program.** J. D. Drinnan, M.I.T., *PB 154588,* 24 Jan. 1961, 11 p. Antenna position information and other interesting data will be recorded on magnetic tapes in IBM format at each of the West Ford sites. These data will permit all interested persons to obtain a general idea about what happens on a particular test day. Additionally, the data may afford insight into specific aspects of the experiment such as belt formation, belt growth, belt deterioration, etc. The Primary Print program was designed to assist in the implementation of the West Ford experiment by affording a detailed printout of the site-produced binary magnetic tape. The amount of output and the items to be printed are governed by a variety of sets of control parameters.

See also :—
Engineering, Structural, Ref. 1739.

BUSINESS

1729 **Fur under the hammer.** D. R. Pierson, *Auto. Data Processing,* **3,** June 1961, 19-21. A general account is given of the problems involved in sales accounting for the bi-monthly Persian lamb auctions of Hudson's Bay Company Limited, fur brokers, and their solution by a LEO service bureau.

1730 **Information sorting in the application of electronic digital computers to business operations.** H. H. Seward, M.I.T., *PB 155376,* 24 May 1954, 68 p. Treatment is given of both digital sorting and sorting by merging. In the majority of cases, sorting may be achieved most economically with punched card machines or magnetic tape devices. In a system incorporating a general purpose computing element, it is generally faster and more economical to use special purpose sorting equipment. For applications involving large amounts of information and requiring rapid sorting, high speed, high density photographic storage may be practical. 21 refs.

See also :—
General, Ref. 1596.
Techniques, Ref. 1649.
Miscellaneous, Ref. 1802.

CHEMICAL

1731 **A combined analog-digital computer for simulation of chemical processes.** S. Shapiro and L. Lapidus, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 24 p. This paper discusses the simulation of the dynamic behaviour of a fixed bed catalytic reactor involving an exothermic reaction on a hybrid analogue-digital computer formed by an IBM 704 linked to an Electronic Associates 48-amplifier analogue computer by means of analogue-to-digital and digital-to-analogue converters. 2 refs.

1732 **Computation of complicated combustion equilibria on high-speed digital computer.** D. S. Villars, Naval Ordnance Test Station, China Lake, California, *PB 153930,* 6 Nov. 1959, 29 p. A reliable and rapid procedure of successive approximations is described which does not require any quantitative estimates of final answers as input data. Current values of concentrations are used to calculate all equilibrium constants. That reaction showing greatest fractional discrepancy between calculated and given equilibrium constant is selected by the program to be computed on the assumption of negligible interactions with the other equilibria. The process is repeated until the maximum discrepancy has been reduced to a value less than an error specified as a parameter of the problem. The program will accept any number of reactions and species. A matrix manipulation may be made to check that the chemical equations are in balance. The machine is then fed a list of chemical equations to be considered for a particular problem. It condenses the original matrix into a smaller working matrix consisting of rows and columns corresponding only to the actual elements and reactions and the actual chemical species to be involved in that particular problem. Speed of convergence is enhanced by transforming the chemical equations to reactions of formation of the various species from components existing at maximal concentrations at equilibrium. After checking that a proposed set of components is tenable, the program conducts the transformation to a new set of chemical equations and obtains the corresponding equilibrium constants. The program is also provided with a capability of computing enthalpies and entropies of the individual species for given temperatures and of the corresponding equilibrium mixture. 3 refs.

See also :—
Physics, Ref. 1789.

CONTROL—PRODUCTION AND PROCESS

1733 **Computer control stretches synthetic rubber plant.** *Control Engng.,* **8,** June 1961, 26. Brief account of automatic control of synthetic rubber-making operations by Goodyear Tire and Rubber Company with an analogue computer specially designed by Goodyear Aircraft Corporation.

See also :—
Miscellaneous, Ref. 1802.

ELECTRONICS

1734 **Computer simulation of a television coding scheme.** S. C. Kitsopoulos and E. R. Kretzmer, *Proc. IRE,* **49,** June 1961, 1076-1077. Letter briefly reporting initial results, obtained by simulation on an IBM 7090, on the performance of television channel-compressing scheme using 'dual-mode' transmission. 4 refs.

1735 **Distributed parameter network synthesis using the potential analog computer.** A. Acampora, Polytechnic Institute of Brooklyn, *PB 150906,* 6 April 1959, 49 p. Since the potential analogue computer is capable of yielding only rational function solutions, attempts to use it to approximate distributed parameter loads in terms of transmission lines and resistors lead to complications. Driving point and transfer impedance as well as scattering coefficients of such approximating networks are, in general, not expressible as rational functions, but are usually transcendental in nature. In this report, a transformation of the complex variable, termed a lambda transformation, $(\lambda = \Sigma + j\Omega)$, is described and used whereby networks consisting of lossless commensurate transmission lines and resistors are directly expressible as rational functions of the transformed variable λ. The computer can be used to achieve networks which approximate a prescribed amplitude and phase response of a certain network function over a defined range of real frequency. 8 refs.

See also :—
Simulation, Ref. 1796*e*.

ENGINEERING, ELECTRICAL

1736 **A general steady-state analysis of power-frequency relations in time-varying reactances.** R. G. Smart, *Proc. IRE,* **49,** June 1961. 1051-1058. A time-varying reactance in an electrical network absorbs power at some frequencies and returns part of this power at other frequencies, the balance being delivered to the source of the reactance changes. This paper presents an analysis of these power transfers and establishes steady-state energy relations which apply under very general conditions to varying reactances, including linear, nonlinear, static and electromechanical systems. This theoretical analysis was undertaken as a basis for digital computer studies of varying reactance systems, since it provides both an over-all description of general characteristics and a means of numerical analysis of particular devices. A fuller account of the work is being prepared. 10 refs.

ENGINEERING, MECHANICAL

1737 **Mathematical analysis and digital computer solution of natural frequencies and normal modes of vibration for a compound isolation mounting system.** L. Katz, David Taylor Model Basin, Washington, D.C., *PB 154507,* Jan. 1961, 21 p. The mathematical analysis and solution of the natural frequencies and normal modes of vibration for a compound isolation mounting system by McGoldrick's method are discussed. The system consists of an assembly supported by a set of isolation mountings carried by a cradle which is, in turn, supported by another set of isolation mountings attached to the hull of a ship. The solution for a single, resiliently mounted rigid body is presented as a special case of the two-body system. Instructions for obtaining computation service at the Applied Mathematics Laboratory, David Taylor Model Basin, and specifications for requisite data are included. 7 refs.

ENGINEERING, STRUCTURAL

1738 **Elektronische Berechnung von torsionssteifen Trägerrosten.** (Electronic computation of torsionally rigid girder structures.) J. Hintzen, *Elektronische Datenverarbeitung,* No. 1, 1961, 28-36. (In German) This paper describes a method, suitable for digital computer programming, for the calculation of girder structures with torsionally rigid longitudinal and transverse girders. The method is based essentially on the application of vector and matrix algebra. 3 refs.

1739 **Responses of plates and shells to intense external loads of short duration.** E. A. Witmer, W. Herrmann et al, M.I.T., *PB 155090,* April 1960, 145 p. The problem is examined of predicting the damage incurred by simple single-material shell structures such as cylinders and spheres when subjected to intense distributed external loading of extremely short duration. A tentative analysis of the intense stress wave propagation and spalling problem was formulated. The equations were programmed for solution on an IBM 704 and are currently being studied. An approximate analysis was formulated for the prediction of buckling type damage to circumvent the enormous complexities of an exact calculation. This analysis consists of an energy method employing assumed patterns or modes of deformation for an unspalled shell or the unspalled portion of a shell which has undergone spalling immediately prior to experiencing the subject buckling damage. 128 refs.

INFORMATION RETRIEVAL

1740 **Information retrieval: finding a needle in a haystack.** *Control Engng.,* **8,** June 1961, 22-24. Brief account of information retrieval activities at Western Reserve University with their electromagnetic literature selector and the recently installed GE 225 digital computer. Brief mention is also made of activities elsewhere in the fields of optical character recognition, automatic abstracting and language translation and their relation to completely automatic information retrieval.

1741 **The application of simple pattern inclusion selection to large-scale information retrieval systems.** C. N. Mooers, Zator Co., *PB 155068,* April 1959, 26 p. Simple pattern inclusion selection coding for information retrieval can speed up the serial scanning rate of some present retrieval machines 4 to 25 times. It may also make possible machines with simpler hardware or selective circuits. One present device has a potential retrieval scanning rate of 36 million items per hour with pattern inclusion selection. Set against the advantages of this method of coding are certain peculiarities or limitations: (1) retrieval prescriptions can be formed by conjoint descriptors only (combined only by AND); (2) the coding method produces a small fraction of extra noise selections. For many retrieval applications, particularly with some very large collections, these peculiarities are of less importance than the gain in scanning speed. The conditions under which simple pattern inclusion selection can be advantageously used are stated, and the code system design rules are given. 7 refs.

1742 **Guidelines for using ASTIA descriptors.** Armed Services Technical Information Agency, *PB 171519,* Feb. 1961, 17 p. Drastic changes in the philosophy of subject indexing were undertaken when the U.S. Armed Services Technical Information Agency (ASTIA) recently automated its information retrieval functions. A *Thesaurus of ASTIA Descriptors* (see *C.A.,* **4,** Sept. 1960, Ref. 1854) was developed to take the place of the ASTIA *Subject Headings.* The concepts behind the arrangement of the *Thesaurus,* the development of its vocabulary, and the use of the terminology, for both input and output operations, are discussed. The use of 'open-ended terms' such as trade names, nomenclature, project titles and the like is also explained as supplementing the descriptors for retrieval purposes.

MECHANICAL TRANSLATION

1743 **The automation of general semantics.** F. W. Householder and J. Lyons, Indiana University, *PB 153805,* 16 Dec. 1960, 11 p. Report on research on the syntactic and semantic analysis of scientific English with the aid of an electronic computer. The primary aim of the research is the development of general mechanical routines for the reduction of complex sentences to their constituent simple sentences without loss of information content. Progress is described on work directed to: (1) the collection of a representative corpus of scientific writing in English; (2) key-punching and sorting the preliminary more limited corpus; (3) the elaboration of dictionary look-up and suffix-splitting routines for English (4) the mechanical determination of the syntactic function of words and of the boundaries of phrases and clauses. 2 refs.

1744 **Computer set AN/GSQ-16 (XW-1). Volume I: The photoscopic memory system.** Int. Business Machines Corp., *PB 150086-1,* 20 June 1959, 31 p. An initial working system for translating Russian into English utilises a large capacity photoscopic memory with fast access time as the primary tool. The requirements for real-time translation of Russian technical literature are discussed and the degree is indicated to which the present, or Mark I, system is capable of meeting these. The over-all operation of this system is described stressing the logic of the search procedure and other design features of the memory which make the system workable. Since the translating power of the memory depends upon the dictionary information stored within it, the techniques and devices for preparing this information and loading it onto the storage disc are also described. See also Refs. 1745 to 1749.

1745 **Computer set AN/GSQ-16 (XW-1). Volume II: The film making unit.** Int. Business Machines Corp., *PB 150086-2,* 20 June 1959, 180 p. The process of converting information on paper or magnetic tape requires a combination of electronic, optical and mechanical systems, each representing separate design problems. Parameters are derived for the individual systems and their relationship to the over-all system function is defined. The actual equipment designed and constructed to embody these parameters is described in detail. Instructions for adjusting and operating this equipment are also provided and supplemented by pertinent mechanical and electrical drawings. See also Refs. 1744 and 1746 to 1749.

1746 **Computer set AN/GSQ-16 (XW-1). Volume III: The disc making unit.** Int. Business Machines Corp., *PB 150086-3,* 20 June 1959, 126 p. The film-to-disc transfer process involves a conversion of the information tracks to circular form and a minification of approximately 55. Both film and disc must be run smoothly in synchronisation to keep the information marks from varying in width as they are laid down. Because of the smallness and density of the spots, optical specifications are extremely stringent, as are those for processing the disc after it has been exposed. Requirements as to mechanics and optics are defined in detail. The equipment built to meet these requirements is then described and its performance discussed. Instructions for making and processing a disc as well as for maintaining the system are included along with a set of pertinent mechanical drawings. See also Refs. 1744, 1745 and 1747 to 1749.

1747 **Computer set AN/GSQ-16 (XW-1). Volume IV: The disc reader.** Int. Business Machines Corp., *PB 150086-4,* 20 June 1959, 181 p. The general principles involved in the use of a c.r.t. spot to scan information densely stored in an emulsion on a rotating glass disc are discussed at length and followed by a description of the special features of the search in the AN/GSQ-16 system. In this system, the spot is focussed by a lens which can be moved transversely across the information tracks. A track following servo system controls both the lens and the spot deflection. Signals produced in a photo-multiplier by passage of the spot through the disc are recognised in a digit detector and converted to binary form for use in the comparator where they are matched against the contents of the input register. Both time response and circuitry are explained in full and the error problem is analysed. See also Refs. 1744 to 1746, 1748 and 1749.

1748 **Computer set AN/GSQ-16 (XW-1). Volume V: The search system.** Int. Business Machines Corp., *PB 150086-5,* 20 June 1959, 285 p. The search system consists of circuitry that controls the flow of lexical information through the system and the logical operation of the disc reader. A computer set, which is the main component of the system, contains the low and high speed electronics required to accomplish the desired functions. The low speed circuits order the transfer of information upon command from the terminal devices and also provide for transliteration and format control. The main function of the high speed system is to compare the information delivered by the disc reader with that stored in the input register. Instructions are supplied to the disc reader to direct the search until a match is detected; upon a match, signals are generated to activate the readout circuitry. The logic is described through which all the above functions are accomplished and the electronics for carrying this logic out. Also described are the power supplies and the input-output device insofar as these relate to the computer operation. A set of test instructions and pertinent schematic drawings are included to assist in operation and maintenance. See also Refs. 1744 to 1747 and 1749.

1749 **Computer set AN/GSQ-16 (XW-1). Volume VI: Information coding and format.** Int. Business Machines Corp., *PB 150086-6,* 20 June 1959, 66 p. The form and content of the store, with the form of information as it enters, passes through and leaves the translation system is discussed. All symbols and codes used are described and located on the encoding devices. The make-up of word list entries is next discussed, particularly as it relates to the look-up scheme. This scheme also requires that the entries be ordered in a particular way, and the word list processing required to achieve this order on the storage disc is described. The conventions that govern information transfer throughout the system are given and followed by a description of the translation procedure. 1 ref. See also Refs. 1744 to 1748.

MEDICAL

1750 **Analyse biologischer Mehrkammersysteme mit dem elektronischen Analogrechner** (Analysing biological multi-compartment systems with the electronic analogue computer). W. Mildner and W. Ameling, *Elektronische Datenverarbeitung,* No. 2, 1961, 82-89. (In German) An introduction to biological compartment systems is given and simulations on the analogue computer are described. There are no restrictions on simulated models as to system and number of compartments. The solution or solutions appear as stationary curves on an oscillograph and the appropriate parameters can be read off directly.

1751 **Computer helps physicians diagnose.** *Data Processing (Detroit),* **3,** June 1961, 21-23. An account of an experiment in medical diagnosis by computer being conducted by the Heart Research Foundation and Lockheed Aircraft's Missiles and Space Division. The latter's IBM 7090 is used to analyse data on heart diseases.

MILITARY

1752 **Evaluation of an intercept trajectory problem solved on a combined analog digital system.** H. D. Gilman, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 41 p. This paper is concerned with an application of the combined analogue digital computer system of the General Electric Missile and Space Vehicle Department. The system, described more fully in Ref. 1605, consisted for this application of an IBM 704, an Electronic Associates 231R analogue computer and HYCOL, the Hybrid Computer Link. The application is to a missile target-intercept trajectory problem. The distribution of the programming between the computers is described and the results are analysed. Sources of error and their effects on the solution are indicated and schemes for minimisation of errors and running time are presented. 3 refs.

1753 **Hybrid computer setup for missile flight analysis and control.** G. Hintze and H. L. McJunkin, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 35 p. After a brief discussion of the missile flight analysis and control problem, a general description is given of analogue-digital procedure for flight analysis and control of a typical missile system. The mathematical equations and analytical procedures involved in the procedure are then discussed. Analogue and digital computer requirements for carrying out these procedures are specified and, finally, the capabilities of certain computers available or forthcoming, are evaluated in terms of the specified real-time analysis computer requirements.

1754 **Recent experiments in missile flight dynamics simulation with the Convair "ADDAVERTER" System.** A. N. Wilson, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 8 p. A general account is given of experiments at Convair-Astronautics in the simulation of missile flight dynamics with a multi-console Electronic Associates general purpose analogue computer linked to to an IBM 7090 digital computer by means of an Epsco ADDAVERTER. 4 refs.

1755 **STARDAC: a hybrid computer keeps sub on target.** G. D. Beinhocker and T. J. Fitzgerald, *Control Engng.,* **8,** June 1961, 101-105. A Polaris missile-firing submarine employs a complex inertial navigation system to determine the precise position of the submarine at the time of firing. The gyros in such a system drift, so corrections must be applied. This is done by periodically fixing a star precisely through the periscope and using a special purpose computer, STARDAC, to calculate the drift. This article explains how the calculations are performed by STARDAC which uses both conventional binary arithmetic and, to generate trigonometric approximations with extremely high accuracy, incremental techniques.

1756 **Digital computer program for superelevation cam design.** M. Archambault, Ordnance Tank-Automotive Command, Center Line, Michigan, *PB 153866,* 18 Nov. 1960, 83 p. A digital computer program is presented for the rapid calculation of manufacturing data essential to the design of preproduction cams which are utilised in ballistic computers of tank fire control systems. The cam profile generated introduces the superelevation angle required by tank main armament for a particular type ammunition.

1757 **An introduction to ballistic missiles. Volume IV. Guidance techniques.** S. F. Anderson, R. F. Kiddle et al, Air Force Ballistic Missile Division, *PB 171250,* 1 March 1960, 238 p. Chapter 1 presents the main functions of a guidance system and gives the general features of radar and all-inertial guidance. Concepts of guidance computation and the function of guidance equations are introduced. Radar techniques used to measure range, angle or velocity of the missile are described in Chapter 2. Chapter 3 discusses inertial navigation, including gyroscopes, accelerometers, stabilised platforms and airborne computers. Chapter 4 summarises the relative merits of analogue and digital computers for use in ballistic missile guidance systems and includes a short description of digital computer arithmetic. 15 refs.

1758 **The spherical Taylor wave for the gaseous products of solid explosives.** M. Lutzky, Naval Ordnance Lab., *PB 154578*, 19 May 1960, 32 p. The results of machine computations of the Taylor wave for the gaseous products of various spherical, solid explosives are presented. The explosives considered include TNT, pentolite, cyclotol 65/35, cyclotol 60/40, TNETB, RDX, tetryl and nitroguanidine. The computations were based on the equation of state $E=PV/\gamma-1$ for the explosion products. Numerical data are given that may be used as initial data in a calculation of the effects of the detonation of a spherical explosive charge on the surrounding fluid. Results of a calculation designed to check the energy balance are presented, in which the heat of detonation calculated from the data is compared with the accepted heat of detonation calculated by means of the Brinkley-Wilson mechanism. A description of the machine program is also given, so that similar computations may be made for an arbitrary explosive. 4 refs.

See also :—
Techniques, Ref. 1649.
Accessories, Ref. 1657.
Simulation, Refs. 1796*c* and 1796*d*.
Miscellaneous, Ref. 1802.

NUCLEAR

1759 **Analogue studies of the boiling heavy water reactor in Halden.** H. Schmidl, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 116-123. The nuclear reactor at Halden, Norway, is designed to produce steam by boiling heavy water in a natural uranium metal core. This paper describes analogue computing methods used to study the dynamics of the reactor and presents some results obtained. The model studies were developed from the EBWR-model at Argonne National Laboratory.

1760 **Analogue study of the axial dynamics in a gas/graphite reactor.** A. Facchini and V. Gervasio, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 71-77. In natural uranium graphite gas cooled reactors, Xenon poisoning and moderator positive temperature coefficient can generate deformations and sometimes instabilities of neutron flux. A mathematical model of these phenomena which can be set up on an analogue computer is of some interest, and in this paper a cylindrical reactor is studied. Certain assumptions are made which result in a simple model that is useful in studying the axial dynamics in a reactor in which the radial and azimuthal flux pattern is maintained stable by appropriate control means.

1761 **Emploi d'un calculateur analogique pour la détermination de la réactivité à long terme d'un réacteur à graphite et gaz.** (Use of an analogue computer for the determination of the long term reactivity of a graphite and gas reactor.) P. Basso, V. Gervasio and C. Passarini, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 131-135, disc. 136. (In French) This paper gives an account of the solution of a system of ordinary differential equations involved in long term reactivity calculations, on a PACE 231R analogue computer at AGIP Nucleaire. The system of equations is presented and the physical nature of the problem is indicated. There follows an account of the analogue system employed, with some remarks on the scaling and on the procedures adopted to make the setup of problems for different practical cases, automatic and simple. Finally, some results obtained are discussed. 5 refs.

1762 **Etude analogique d'un problème de thermalisation et de diffusion.** (Analogue study of a thermalisation and diffusion problem.) P. Coet and J. Devooght, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 13-22, disc. 22-23. (In French) This paper is concerned with the study by means of a resistance network of the problem of thermalisation in the cell of a heterogeneous reactor. There is no adequate theory of thermalisation with diffusion, analytical methods being ill-adapted to rapid variations in absorption or to heterogeneous structures. Thermalisation of neutrons in the range of $0 \ll E \ll kT$, in a plane cell formed of a plate of natural uranium and a plate of graphite is investigated. 10 refs.

1763 **Sur l'étude comparative du refroidissement des gainages par analogie rhéoélectrique.** (On the comparative study of cooling of sheaths by rheoelectric analogy.) G. Burnay, J. Vidal and V. Moreau, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 124-127. (In French) A brief account of initial work at the University of Liege on the use of rheoelectric analogues for determining the comparative thermal efficiency of longitudinally finned sheaths for uranium rods.

1764 **Etude de la distribution des températures dans une cartouche de pile.** (Study of the temperature distribution in a nuclear fuel element.) G. Renard and E. de Robert, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 34-37. (In French) The difficulties in ascertaining the temperature distribution in a nuclear fuel element, which is essentially composed of materials (uranium and the sheath material) having different mechanical and thermal properties, is discussed and it is shown a resistance network is particularly suited for such investigation.

1765 **The LANCE reactor analogue computer.** R. F. Mathams, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 111-114, disc. 115. This paper describes LANCE, an analogue computer at the A.E.I. Research Laboratory, Aldermaston, which is mainly used for studying the transient behaviour of MERLIN, a 5 MW pool-type research reactor. 4 refs.

1766 **Méthodes de calcul en cinétique et thermique des réacteurs nucléaires.** (Methods of computation in kinetic and thermal studies of nuclear reactors.) R. Vichnevetsky, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 51-55, disc. 55-57. (In French) This paper surveys recent work on the solution by analogue computation of partial differential equations describing the behaviour of nuclear reactors and compares the finite difference and modal approaches. Topics which are considered particularly are the problem of choosing the cell size in the finite difference technique for neutron and thermal studies and the model technique in the study of control and of the kinetics of reactors. 16 refs.

1767 **The multi-point simulation of a nuclear reactor.** D. L. Booth, B. E. Cunio, G. V. Greatorex and T. O. Jeffries, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 24-29, disc. 30-33. The reduction of the neutron diffusion equation to a form suitable for spatial simulation of a reactor is discussed, together with the associated representation of the fuel and moderator heat transfer equations for a gas-cooled, graphite moderated system. The accuracy of the finite difference method of solving the equations is assessed and some results of the transient variation in axial flux shapes obtained from a four-point model are given for various fault conditions. Some details, including a schematic diagram, are given of the English Electric reactor simulator Pluto, an electronic analogue computer which computes the behaviour of a single channel in a reactor. In this simulator, the spatial, time dependent heat equations and the one group neutron diffusion equations are solved in finite difference form.

1768 **The nuclear reactor simulator and the associated thermal plant simulator.** M. D. Ajnbinder, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 58-68, disc. 69-70. This paper describes a nuclear reactor simulator and also a thermal or power plant simulator which can be coupled to the reactor simulator (both being of analogue type). Block diagrams are presented and the principal circuits are described. Applications in the fields of research, teaching and operator training are indicated. Typical teaching experiments with the two simulators are outlined. It is stated that the paper is based on information supplied by the Nuclear Control Section of the Systems Engineering Division of Minneapolis-Honeywell Regulator Company. 12 refs.

1769 **An outline of current nuclear analogue work in the C.E.G.B.** R. A. Laws, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 128-129, disc. 130. A brief report of work on the study of nuclear reactor behaviour in progress at the analogue computation centre of the Central Electricity Generating Board.

1770 **Problèmes généraux posés par la résolution analogique des équations cinétiques des réacteurs nucléaires.** (General problems raised by the analogue solution of kinetic equations of nuclear reactors.) C. Caillet, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 137-143, disc. 143-144. (In French) This paper discusses scaling problems involved in the analogue solution of kinetic equations of nuclear reactors, and compares the accuracies obtainable with analogue and digital computers. 9 refs.

1771 **Quelques résultats de la théorie dynamique des réacteurs.** (Some results of the dynamic theory of reactors.) H. B. Smets, *Seminar Analogue Methods Nuclear Energy Problems Proc.*, 1961, 78-84. (In French) This paper presents certain stability characteristics derived from the dynamic theory of reactors and discusses their application in analogue computation of the dynamic behaviour of reactors. Two methods of stability analysis are indicated and some results of start-up accident calculations are given. 13 refs.

1772 **Quelques types de difficultés rencontrées lors de la simulation des échangeurs.** (Some difficulties encountered in the simulation of exchangers.) D. Bettembourg, *Seminar Analogue Methods Nuclear Energy Problems Proc.,* 1961, 103-107, disc. 107-108. (In French) The analogue simulation of heat exchangers for nuclear and other power plants raise certain problems which are often difficult to resolve. The difficulties appear in formulating equations for the physical phenomena; they appear also in solving the equations because more and more complex formulations tend to result in unstable electronic circuits. In this paper, difficulties in the analysis of various types of heat exchangers are discussed and, in each case, the way in which they may be overcome is indicated.

1773 **Some applications of analogue computers in atomic power research.** T. Kawai, T. Kanai, T. Miura and M. Suzuki, *Seminar Analogue Methods Nuclear Energy Problems Proc.,* 1961, 38-49, disc. 50. This paper describes some applications of the Hitachi low speed analogue computer to problems in atomic power research, which include computations of linear and nonlinear simultaneous differential equations and of two point boundary value problems. The applications are: (1) Transient temperature distribution in a fuel rod during reactivity accidents. This is part of a safety analysis of a proposed experimental, water moderated, heterogenous reactor, the main problem being to determine whether temperature of fuel and heat flux through a fuel surface will exceed certain limits and cause melting of fuel rods. (2) Axial flux and void distribution in a boiling water reactor, a nonlinear, two-point boundary value problem. (3) Stability of the control system of power reactors. Analyses of the dynamic characteristics of a pressurised water reactor and a British-type gas-cooled reactor. (4) Pressure response to the load change in a pressurised water reactor. Analysis of the response of the pressure change in the primary cooling system pressuriser to load change in the reactor. (5) Start up of the British-type power reactor. Analysis of the response of reactor power to the withdrawal of control rods. (6) Behaviour of an ion which is accelerated in an oscillating magnetic field. Investigation of the behaviour of an ion inside a cyclotron.

1774 **Some remarks on the ways of simulating reactor kinetic equations.** J. van Eenennaam, *Seminar Analogue Methods Nuclear Energy Problems Proc.,* 1961, 85-90. This paper summarises the different ways in which the kinetic behaviour of a reactor core may be simulated. The kinetic equations which are valid for different types of reactors are indicated. For calculations on the linear scale, different types of analogue computers, with operational amplifiers and with passive networks are discussed. For computations on a logarithmic scale, only an operational amplifier computer is considered. Some results of calculations on a PACE 16-31 R computer are presented. 3 refs.

1775 **The use of analogues in university studies of nuclear reactors.** J. C. Cluley and D. Jakeman, *Seminar Analogue Methods Nuclear Energy Problems Proc.,* 1961, 91-102, disc. 102. This paper describes the analogue computing equipment used in the teaching of nuclear science and engineering to post-graduate students at the University of Birmingham. The major items are two reactor kinetics simulators, the first a commercial product and the second a relatively inexpensive machine built in the Department of Electrical Engineering. The main features of these two electronic analogue simulators are described, the second in more detail, including the circuits dealing with neutron kinetics, thermal effects and Xenon poisoning, and examples of their use are given. Both of the simulators compute the time variations of the reactor state, averaged over the entire volume. An electrical spatial flux simulator using many of the components of the kinetics simulator has been constructed to enable the variation of flux along one dimension of the reactor to be determined under steady state conditions. The reactor can consist of up to four zones having positive or negative buckling. Also described is a technique using the analogy between neutron flux and the temperature within a solid body, which enables the flux distribution within a reactor to be investigated. This technique is particularly valuable for examining reactor systems having a complex geometry and for determining the reactivity taken up for various configurations of control rods. Finally, a short description is given of other analogue techniques used for teaching, such as passive electrical networks and the electrolytic tank. 14 refs.

1776 **COFIT—A 709 program for determining extrapolation length from horizontal traverse data.** D. D. Matsumoto, Gen. Electric Co., *HW-61204,* Aug. 1959, 15 p.

1777 **Comparison of Monte Carlo calculation and experimental measurements for gamma-ray air scattering.** D. M. Dawson, W. L. Kirk et al, Wright-Patterson AFB, *PB155257,* Aug. 1958, 26 p. Convair has reported an experimental determination of the angular distribution and energy spectrum of air scattered gamma rays from a cobalt-60 source. Lynch, Johnson, Benoit and Zerby have reported the results of a Monte Carlo study of gamma ray air scattering from a monoenergetic beam source which was performed on a UNIVAC 1103. This program has been modified to perform similar calculations for a monoenergetic point isotropic source. The code was further modified to print separately photon currents due to first collisions, to second collisions, to third collisions and to all higher order collisions. The angular distribution and energy spectra as reported by Convair are compared with the results of Lynch et al, and with results obtained with the modified program. In general, the agreement between theory and experiment is within a factor of two. 2 refs.

1778 **Determination of lattice parameters with the aid of a computer.** M. H. Mueller and L. Heaton, Argonne National Laboratory, *ANL-6176,* Jan. 1961, 29 p.

1779 **IBM 704 programs for unfolding complex gamma-ray spectra.** W. B. Strickfaden and R. M. Kloepper, Los Alamos Scientific Laboratory, *LA-2461,* Sept. 1960, 126 p.

1780 **Instructions for the operation of an Oracle code for a Monte Carlo solution of the transport problem for gamma rays incident upon a slab.** S. Auslender and D. K. Trubey, Oak Ridge National Laboratory, *CF-60-10-37,* Oct. 1960, 39 p.

1781 **A method of calculating the density of thermal neutrons in a slab.** F. Forelli, Naval Radiological Defense Lab., *PB 153891,* 17 March 1960, 26 p. A trial application of Grossjean's method of calculating multiple scattering of particles has been made for the case of a plane isotropic source of thermal neutrons in a slab of finite thickness. The method involves the expansion of the neutron distribution in Legendre polynomials and is stated to be suitable for use with an electronic computing machine. 2 refs.

1782 **MUFT-5—A fast neutron spectrum program for the Philco-2000.** H. Bohl and A. P. Hemphill, Westinghouse Electric Corp., *WAPD-TM-218,* Feb. 1961, 94 p.

1783 **Nuclear reactor depletion programs for the Philco-2000 computer.** O. J. Marlowe et al., Westinghouse Electric Corp., *WAPD-TM-221,* Jan. 1961, 118 p.

1784 **Numerical solution of reactor stress problems.** R. F. Redmond et al., Battelle Memorial Institute, *BMI-1503,* Feb. 1961, 53 p.

1785 **PRESTO—A pressurizer transient program for the IBM-704.** J. P. Cunningham and H. R. Meyer, Westinghouse Electric Corp., *YAEC-141,* Aug. 1960, 146 p.

1786 **RANCH—an IBM-704 program used to solve the one-dimensional, single energy neutron transport equation with anisotropic scattering.** L. A. Hageman and J. T. Mandel, Westinghouse Electric Corp., *WAPD-TM-268,* Feb. 1961, 25 p.

1787 **Sourceless startup. A machine code for computing low-source reactor startups.** D. B. MacMillan, Knolls Atomic Power Laboratory, *KAPL-M-DBM-1 (Rev. I),* June 1960, 6 p.

1788 **A time-based analysis of GMD-1 data for electronic computers.** R. L. Levesque, Sandia Corp., *SCTM-35-61(72),* Feb. 1961, 7 p.

See also :—
General, Ref. 1597.

PHYSICS

1789 **Crystallographic computations.** E. L. Eichhorn, *Elektronische Datenverarbeitung,* No. 2, 1961, 71-75. A general account is given of the use of digital computers in the areas of crystallographic structure research, particularly X-ray diffraction. 8 refs.

0 **Beam optics analysis using the IBM 650.** P. E. Schlein, ins Hopkins University, *PB 154261,* Nov. 1960, 28 p. This ort describes an IBM 650 program BOMMIT (Beam Optics atrix Multiplication and Iteration) which greatly facilitates design of precision beam optics. A beam system consisting of arbitrary ordering, type and number of optical elements up a maximum of 50 can be considered. The matrix method is d.

91 **Closed form evaluation of the thermodynamic properties steam in the subcritical region.** J. C. Boehringer, M.I.T., *148353,* June 1960, 73 p. Attempts were made to extend a mulation of the thermodynamic properties of steam to temratures below the critical temperature in a form suitable for in computers. A reasonable degree of accuracy was obtained the region from 10 to about 5 cc/g and subcritical temperes. The shortcomings of this type of application of Chebyshev lynomials were illuminated. The IBM programs for deterning coefficients and the thermodynamic properties from the lynomial equation were written in such form that they can sily be interpreted and, with simple changes, can be used with ner primitive equations over other regions for steam or any her substance. The original equation by Keyes, which was used generalise data at very specific points that permit determinaon of coefficients for the Chebyshev polynomials, was corrected th the help of Program M830-669-Boehringer-3. 17 refs.

92 **Computation of order parameters in an ising lattice by the onte Carlo method.** J. R. Ehrman, L. D. Fosdick and D. C. andscomb, University of Illinois, *PB 154103,* 15 April 1960, p. The long-range and short-range order parameters have en computed on ILLIAC for the ising lattice using a Monte arlo sampling scheme. The square lattice, the simple cubic ttice and the body-centered cubic lattice are considered. In the ree-dimensional calculations, both the antiferromagnetic and rromagnetic cases are considered as well as the coupling to an ternal magnetic field of various strengths. The method appears give good results for the short-range order even very close the critical temperature, but in this neighbourhood the longnge order estimate is crude. 11 refs.

793 **Some notes on thermoelectric effects. Model, general.** . L. Schilb, Douglas Aircraft Co., Inc., *PB 152061,* 1 July 1960,) p. Thermoelectric equipment will be competitive with other ethods of cooling and power generation in the near future. he basic thermodynamic principles of thermoelectric effects re developed and investigated in this report. Design philosohies are suggested for both cooling and power generation. The asic thermo-physical equations are presented for computer rogramming. A simple computer program for thermoelectric ooling is included. This program will aid feasibility studies of ehicle cooling. 8 refs.

794 **Temperature distribution in a conductor adjacent to a late of infinite conductivity model general.** R. A. Papetti, Douglas Aircraft Co., Inc., *PB 150243,* Aug. 1960, 31 p. An exact xpression which relates the temperature at the interface of two nfinite slabs to time and the material properties of the two labs is obtained for a two-zone system which is perfectly insuated on one external surface and experiences a constant heat nput on the remaining surface. Two analytical models are liscussed. A comparison between the solutions for the two nodels is made for an aluminium-quartz system. The analytical esults for the principal model are plotted along with the comuter solutions of the same problem. The computer solutions re based on the one-dimensional Runge-Kutta analysis of hermal conduction, time-variant problems. Close agreement etween computer and analytical results is obtained. 3 refs.

SIMULATION

1795 **Combined simulation with large and small digital computers: a review and a forecast.** G. A. Bekey and L. W. Neustadt, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 8 p. The history of combined analogue-digital simulation efforts at Space Technology Laboratories, Inc., is reviewed. The problems associated with the operation of a large combined simulation effort (using a 300 amplifier analogue computer and a UNIVAC Scientific 1103A digital computer) are compared with those associated with the use of a small digital computer (Packard Bell PB-250). The types of problems suitable for solution with the two systems are analysed briefly, and future plans for combined simulation are discussed. 6 refs.

1796 **Simulation Council Newsletter.** J. McLeod (Ed.), *Instr. & Control Systems,* **34,** June 1961, 1087, 1089, 1091-1093, 1095-1097. The main items are as follows :

a. **Introduction to SDC,** H. Harmon, p. 1087, 1089. Brief account of System Development Corporation and its System Simulation Research Laboratory for the study of man-machine systems.

b. **Simulation methods in man-machine simulation research.** L. T. Alexander, p. 1089. Brief description of bioscopic simulation, a technique for conducting research on the problems which arise from the design, development, training and evaluation of man-machine systems, and which features the incorporation of live subjects in the system model.

c. **Use of simulation in training.** M. G. Holmen, p. 1089, 1091. Discussion of the use of simulation in training in complex military systems.

d. **Role of manned simulation in operations research.** W. A. Steger, p. 1091. Concerns the use of computer-assisted manned simulation in the planning of complex weapon systems.

e. **Circuit simulation by a direct approach.** R. W. Boucher and C. T. Lecher, p. 1091-1093, 1095. Description of a technique, readily applied by electronic circuit designers, for forming an analogue computer equivalent circuit of an RLC equivalent circuit.

f. **Analog techniques.** M. E. White, p. 1095-1096. An article concerned with heat flow problems in which it is necessary to provide for melting of the various nodes. Analogue computer circuits are presented for computing the nodal temperature and the mass of liquid material at the node.

(Items *a* to *d* are summaries of talks given at the Western Simulation Council meeting of 12 January 1961, and item *e* consists of the almost complete text of a talk given at the Eastern Simulation Council meeting of 20 February 1961.)

TRANSPORT

1797 **Air traffic control goes automatic.** *Int. Electronics,* **1,** June 1961, 41-43. Account of an air traffic control system which employs a special purpose digital computer developed by Librascope Division of General Precision Inc.

1798 **An air traffic control system simulator.** A. S. Jackson and H. I. Ottoson, *Proc. Combined Analog Digital Computer Systems Symposium,* 1960, 13 p. This paper gives a general description of a large scale, man-machine, real-time simulator for the study of terminal area air traffic control systems, developed by the Bureau of Research and Development of the Federal Aviation Agency assisted by TRW Computers Company. The simulator is designed to allow simulation of completely manual systems, computer aided semi-automatic systems, or computer controlled fully automatic systems. The simulator is a combined analogue-digital system utilising a medium-sized general purpose digital computer (Ramo-Wooldridge RW-300), analogue computer aircraft simulators (each 'flown' by a 'pilot'), computer driven tabular displays for the controllers, separate computer input keyboards for each controller, and PPI scopes and other standard IFR room equipment. 4 refs.

1799 **Schnelle Kollisionsprüfung für die Flugsicherung.** (High speed checking for collisions for air traffic control.) E. Jessen, *Elektronische Datenverarbeitung,* No. 2, 1961, 93-99. (In German) The requirements and organisation of a collision test for air traffic control are examined. A test which makes use of precalculated flight plans is described and it is shown that, if the data processing is to cope with a large volume of traffic, even high speed computers are not sufficient. Special apparatus to perform the test is described. 4 refs.

1800 **Untersuchung zur Darstellung von Wegkurven aus gemessenen Beschleunigungen mit Hilfe des elektronischen Analogrechners.** (Investigation of the plotting of paths of motion from measured accelerations with the aid of electronic analogue computers.) W. Mildner and W. Ameling, *Elektronische Datenverarbeitung,* No. 1, 1961, 23-27. (In German) English summary: 'In order to be able to evaluate such factors as the unevenness of roads, the motion of the sea and the vibration of engines the knowledge of the travelling-curve as a function of time would be of interest. Described is a measuring procedure permitting relative and absolute determination of the travelling distance by using active accelerometers and computer amplifiers.'

ee also :—
Programming, Ref. 1721.

SCELLANEOUS

01 **Analog computers' role in the processing industries.** *Auto. ntrol,* **14,** June 1961, 45-47. General discussion of the use of alogue computing elements and analogue computers in process ntrol, simulation and design.

02 **Future applications of combined (digital-analog) systems planning and control.** D. F. Blumberg, *Proc. Combined alog Digital Computer Systems Symposium,* 1960, 12 p. This per discusses present and future application of combined alogue digital computer systems to three types of integrated nning and control systems: process control systems; produc- n control systems; and strategic planning and control tems. The paper deals more particularly with the third type system which is defined as a type of management process ed to evaluate, analyse, implement and monitor the total pro- ammes, plans and operations of a large organisation. Military ategic planning systems incorporating operational gaming are cussed and, more briefly, industrial and heuristic systems. refs.

03 **Over 500 areas of application of computers.** N. Mac- nald, *Computers & Automn.,* **10,** June 1961, 133-137. Over 0 areas of application of computers are listed under the llowing headings: (1) Business and manufacturing in general: ffice; Plant and production. (2) Business—specific fields: nking; Educational and institutional; Finance; Government; surance; Law; Libraries; Magazine publishing; Oil industry; blic utilities; Telephone industry; Transportation; Miscel- neous. (3) Science and engineering: Aeronautical engineering; ology; Chemical engineering and chemistry; Civil engineering; ectrical engineering; Hydraulic engineering; Linguistics; arine engineering; Mathematics; Mechanical engineering; edicine; Metallurgy; Meteorology; Military engineering; aval engineering; Nuclear engineering; Photography; Physics; atistics.

1804 **Improvement, evaluation, and extension of capabilities of meteorological simulation (Dallas Tower Program).** W. H. Clayton, Texas A. & M. Res. Foundation, *PB 154528,* Sept. 1960, 30 p. A review is made of the initial problems and solutions involved in the organisation of an 11 station mesoscale meteorological network designed to provide evaluation data for a special purpose analogue computer (Low Level Meteorological Simulator).

BOOKS

1805 **Proceedings of the Combined Analog Digital Computer Systems Symposium.** Simulation Councils, Inc., 1960, approx. 300 pages, £2. 0. 0. (Bound in loose-leaf form and the pages are not numbered.) This book contains the papers presented at the Combined Analog Digital Computer Systems Symposium sponsored by Simulation Councils, Inc., and the General Electric Missile and Space Vehicle Department, and held at the Sheraton Hotel, Philadelphia, Pennsylvania, U.S.A., on 16-17 December, 1960. The papers are abstracted in Refs. 1605, 1606, 1648, 1650, 1652, 1656, 1657, 1670, 1704, 1714, 1721, 1731, 1752, 1753, 1754, 1795, 1798 and 1802.

1806 **Seminar on Analogue Methods in Nuclear Energy Problems: Proceedings.** R. Gomperts (Ed.), Presses Académiques Européennes, 1961, 144 pages, 325 B. Frs., £2. 6. 6., $6.50. Contains the papers, and discussions thereon, given at the Seminar on Analogue Methods in Nuclear Energy Problems held in Brussels 21-23 April 1960. The papers are abstracted in Refs. 1597 and 1759 to 1775.